

CLAIMS

- 1. A membrane electrode assembly for use in a direct oxidation fuel cell comprising:
- a layer of material which is substantially impermeable to water and carbonaceous
- 3 fuel;
- first and second protonically conductive membranes disposed, respectively, on
- 5 opposite surfaces of said layer;
- selected sites in said layer enabling protonically conductive contact between said
- 7 first and second membranes;
- first and second catalysts disposed, respectively, on the surfaces of said mem-
- 9 branes which are not in contact with said layer; and
- first and second diffusion material layers disposed, respectively, on the surfaces
- of said catalysts which are not in contact with said membranes.
- 1 2. The assembly as in claim 1 wherein said layer comprises a microporous material.
- 1 3. The assembly as in claim 1 wherein said layer comprises a polyester microfilm
- with microperforations.
- 1 4. The assembly as in claim 1 wherein said layer comprises a polyimide film with
- 2 microperforations.
- The assembly as in claim 1 wherein said assembly is used in a direct methanol
- 2 fuel cell.
 - 6. A layered membrane for use in a direct oxidation fuel cell comprising:
- a layer of material which is substantially impermeable to water and carbonaceous
- 3 fuel; and

1

- 4 first and second protonically conductive membranes disposed, respectively, on
- opposite surfaces of said layer; and

- selected sites in said layer enabling protonically conductive contact between said
- 7 first and second membranes.
- 7. The membrane as in claim 6 wherein said layer comprises a microporous material.
- 1 8. The membrane as in claim 6 wherein said layer comprises a polyester microfilm
- with microperforations.
- 1 9. The membrane as in claim 6 wherein said layer comprises a polyimide film with
- 2 microperforations.
- 1 10. The membrane as in claim 6 wherein said membrane is used in a direct methanol
- 2 fuel cell.

1

- 11. A method of constructing a layered membrane for use in a direct oxidation fuel
- 2 cell comprising the steps of:
- providing a layer of material which is substantially impermeable to water and car-
- 4 bonaceous fuel; and
- 5 providing, on opposite sides of said layer, protonically conductive membranes;
- and providing sites in said layer which allow protonically conductive contact be-
- 7 tween said protonically conductive membrane.
- 1 12. The method as in claim 11 wherein said layer comprises a microporous material.
- 1 13. The method as in claim 11 wherein said layer comprises a polyester microfilm
- 2 with microperforations.
- 14. The method as in claim 11 wherein said layer comprises a polyimide film with
- 2 microperforations.

- 15. A method of constructing a membrane electrode assembly for use in a direct oxi-
- dation fuel cell comprising the steps of:
- providing a layer of material which is substantially impermeable to water and car-
- 4 bonaceous fuel and which permeable to protons;
- 5 providing, on opposite sides of said layer, first and second protonically conduc-
- 6 tive membranes:
- 7 providing sites in said layer which allow protonically conductive contact between
- said protonically conductive membrane; and
- providing, on the surfaces of said membranes which are not in contact with said
- layer, first and second catalyst layers; and
- providing, on the surfaces of said first and second catalyst layers which are not in
- contact with said membranes, first and second distribution layers.
- 1 16. The method as in claim 15 wherein said layer comprises a microporous material.
- 1 17. The method as in claim 15 wherein said layer comprises a polyester microfilm
- with microperforations.
- 1 18. The method as in claim 15 wherein said layer comprises a polyimide film with
- 2 microperforations.
- 1 19. A direction oxidation fuel cell comprising:
- an anode;
- a cathode;
- a membrane electrode assembly, said assembly including a layer of material
- which is substantially impermeable to water and fuel, first and second protonically con-
- ductive membranes disposed, respectively, on opposite surfaces of said layer, sites in said
- 7 layer that allow protonically conductive contact between said membranes, first and sec-
- ond catalysts disposed, respectively, on the surfaces of said membranes which are not in
- 9 contact with said layer, and first and second diffusion material layers disposed, respec-
- tively, on the surfaces of said catalysts which are not in contact with said membranes; and

- a housing in which said anode, cathode and assembly are disposed.
- 1 20. The fuel cell as in claim 19 wherein said layer comprises a microporous material.
- 1 21. The fuel cell as in claim 19 wherein said layer comprises a polyester microfilm
- with microperforations.
- 1 22. The fuel cell as in claim 19 wherein said layer comprises a polyimide film with
- 2 microperforations.
- 1 23. The fuel cell as in claim 19 wherein said fuel cell is a direct methanol fuel cell.